

The Properties of CrN/Au and Cr/CrN/Au Multilayers,

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Gold has been used as a conductor material in many microelectronic applications because of its low resistivity, bondability, and oxidation/ corrosion resistance. However, the adhesion of gold layers deposited on glass, ceramics or oxidized substrates is rather poor and a thin multilayer of some metal such as chromium is used to provide the bond. It is well known that significant interdiffusion between Au and Cr takes place at reasonably low temperatures resulting in the rapid increase in the resistance of the gold layer. In this paper we report on the diffusion barrier performance of reactively sputtered CrN layers of different compositions. We have employed backscattering spectrometry, cross sectional transmission electron microscopy, and sheet resistance measurements to characterize the samples processed at different temperatures. The mechanical stress of individual films and the multilayer structures before and after heat treatment was determined using high resolution x-ray diffraction techniques. Modified peel tests were applied to both CrN/Au and Cr/CrN/Au multilayers deposited on silicon oxide and aluminum nitride to test the adhesion of the layers. Our results show that the CrN layer is able to prevent the interdiffusion of the Cr and Au up to 200°C for a 60 minute heat treatment but the adhesion of the CrN to the silicon oxide substrate is poor. An addition of a thin Cr layer improves the adhesion resulting in a thermally stable and well bonded interconnection scheme.